GUIDELINES FOR ENVIRONMENTALLY SOUND MANAGEMENT OF USED OILS IN THE MEDITERRANEAN

Strategic Partnership for the Mediterranean Sea Large Marine Ecosystem
MedPartnership
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Environmentally Sound Management of Used Oils in the Mediterranean

These guidelines have been commissioned by the marine pollution assessment and control unit (MED POL) of the Mediterranean Action Plan (UNEP/MAP) to the Regional Activity Centre for Sustainable Consumption and Production (SCP/RAC) under the MedPartnership Project.

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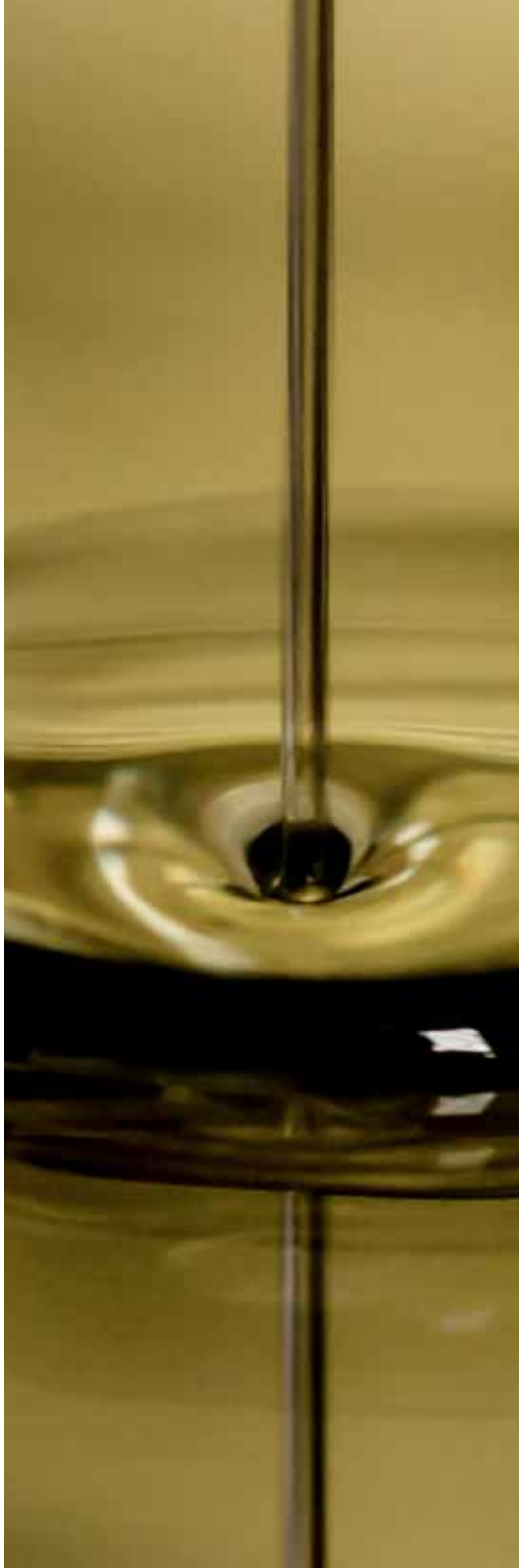

PREFACE

This technical guide is focused on providing possible steps to the environmentally sound management (ESM) of used oils and to provide the Mediterranean countries with information in order to establish a 100% regeneration system to recycle used oils. Its ultimate objective is to support countries to design and set up an effective used lubricant oil management including prevention, as well as to promote its economic value and the circular economy.

It has been developed by the Regional Activity Centre for Sustainable Consumption and Production (SCP/RAC) in collaboration with UNEP/MAP MED POL Programme, under the MedPartnership project[1].

Used oils, or waste oils, are priority substances to be taken into account for the Contracting Parties to the Barcelona Convention when preparing programmes and measures against pollution, according to the Land Based Sources (LBS) Protocol. Used oil as a hazardous waste is also covered by the Basel Convention on control of transboundary movements of hazardous wastes and their disposal.

Used oil mainly contains three types of dangerous pollutants, polynuclear aromatic hydrocarbons (PAHs), heavy metals and lubrication additives. It is a dangerous polluting product, usually generated by its use as a lubricant in automotive vehicles and in industrial operations and classified as hazardous waste according to European environmental legislation. Pollution due to used oil has not received much attention compared to pollution from petroleum. Its inadequate management can have significant effects on wetlands, rivers, marine and fresh water organisms, air pollution and human health.

This technical guide provides background information and data on used oils, information on ecolabelling for lubricants and alternatives such as bio-lubricants, associated environmental problems caused by used oils as well as information on the main used oil treatment technologies.

It also describes in plain and simple language the possible steps towards the environmentally sound management of used oils that can generally be applied to any given country that goes from stakeholder engagement to final re-refining/ recycling and shows several case studies on used oil pollution prevention.

This guide aims at facilitating policy and legislation reforms for pollution prevention and control. It seeks to develop and improve the legislative and institutional framework in the Mediterranean region and to serve as a technical guidance for the Mediterranean countries in implementing the relevant priority actions of the National Action Plans adopted in the framework of Article 5 and 15 of the LBS Protocol of the Barcelona Convention and its Strategic Action Programme SAP-MED.

1. The Strategic Partnership for the Mediterranean Sea Large Marine Ecosystem (MedPartnership) is a collective effort of leading organizations (regional, international, nongovernmental, etc.) and countries sharing the Mediterranean Sea towards the protection of the marine and coastal environment of the Mediterranean. The MedPartnership is being led by United Nations Environment Programme (UNEP) Mediterranean Action Plan (MAP) and the World Bank and is financially supported by the Global Environment Facility (GEF), and other donors, including the European Union (EU) and all participating countries.

TABLE OF CONTENTS

POLLUTION PREVENTION

Pollution prevention is any action that reduces, eliminates, or prevents pollution at source. It is obvious that there are significant opportunities for industry to reduce or prevent pollution at source through cost-effective changes in production, operation, and raw material use.
In the case of used oils, our first priority should be to take prevention actions with the goal of generating zero used oil. In addition, biolubricants (plant-based lubricants) represent an opportunity to greatly reduce the environmental impact of lubricants and create green companies and jobs. Ecolabels are also a way to promote best environmental practices and reduce lubricants' environmental impact.

1.1 Alternatives to mineral oils: Biolubricants

Biolubricants, also known as biolubes and bio-based lubricants, apply to all lubricants that biodegrade rapidly and which are non-toxic for human beings, fauna, flora and aquatic habitats.

Biolubricants are made of vegetable oils such as soybean, canola (rapeseed), sunflower, jojoba, jatropha, palm and coconut oils. Biolubricants can also be made of synthetic esters manufactured from modified renewal oils.

The preferred application of biolubricants are those that might pose a risk for the environment, especially in aquatic, mountain, mining, pharmaceutical, agricultural and forest environments, although they can be used in all applications.

This is the case for:

- Machinery or applications that directly leak oil into the environment such as chainsaw bars and chain oils, 2 stroke-engines, railway flanges, cables, dust suppressants, marine equipment and release agents and greases.
- Machinery working on sensitive areas that may accidentally leak oil (in or near water bodies) such as hydraulic oils, oils for engines, gearboxes, axles, etc.

The key advantages of biolubricants are rapid biodegradability, low toxicity in the environment, environmental friendliness, good lubricating properties, high viscosity index, longer equipment life, contribution to improved water quality, reduction of greenhouse gases, increase in economic security and reduction of oil dependence.

Biolubricants management should

follow a separate recycling system from petroleum-based used lubricant oils. Used biolubricant oils containing heavy metals and other hazardous substances should be managed as hazardous waste, implementing environmentally sound management and complying with local environmental legislation.

The advantages of biolubricants compared to petroleum-based lubricants are as follows:

- Safer for staff working with lubricant oils since they are cleaner, non-toxic, and generates fewer skin problems;
- Better safety, since they have higher flashpoints, constant viscosity, and less oil mist and vapour emissions;
- Air emissions are lower due to higher boiling temperature ranges of esters.
- Rapid biodegradability;
- Costs are less over the product's life-cycle due to less maintenance, storage and disposal requirements. If spilled, environmental and safety penalties are less;
- Evaporate slower than petroleum lubricants; and
- Adhere better to metal surfaces.

The disadvantages of biolubricants during the use phase are:

- Bad odours may appear if contaminants are present;
- High viscosity at low temperatures; and
- Poor oxidative stability at extremely high and low temperatures, although specific additives (not biodegradable) solve this problem.

In spite of this, the price levels of plant-based oils and lubricants historically have been higher compared to petroleum-based oils and lubricants although, in recent years, this price difference has reduced considerably. Today, the cost of biolubricants is slightly higher than mineral oil lubricants, but equal to or less than synthetic lubricants. This global trend indicates a promising future for biolubricants. If the price of petroleum base oils increases, biolubricants will be even more competitive in the formulation of lubricants or as 100% bio-based lubricants.

Besides environmental benefits, biolubricants are a reliable alternative, providing improved performance over conventional lubricants. In particular, the lubricity of biobased lubricants is about 2 to 4 times greater than petroleum-based lubricants, reducing energy consumption and lengthening the equipment's service life. In addition, the viscosity of biolubricants does not vary with temperature as much as the petroleum-based lubricants. Finally, biolubricants have a very good safety record in applications like grinding, where a fire hazard may be present.

Approximately 85% of all lubricants presently being used in the world are petroleum based oils. Nevertheless, the market for more biolubricants has been growing at a slow but steady pace. Europe has been leading the biobased lubricant market and it is expected to grow to 18% of the market in the coming years.

1.2 Ecolabels for lubricants

It is recommended to use ecolabels to promote best environmental practices. Among the most well-known ecolabels are those developed by the European Union, which have a specific ecolabel for lubricants.

The European Union Ecolabel covers a wide range of product groups, from major areas of manufacturing to tourist accommodation services. Key experts, in consultation with main stakeholders, develop the criteria for each product group in order to decrease the main environmental impacts over the entire life cycle of the product. Because the life cycle of every product and service is different, the criteria are tailored to address the unique characteristics of each product type.
The European Union Ecolabel helps consumers to identify products and services that have a reduced environmental impact throughout their life cycle, from the extraction of raw material through to production, use and disposal. This ecolabel is a voluntary label promoting environmental excellence at European level.

With regard to the ecolabel on lubricants, the products that can apply for the ecolabel cover hydraulic fluids, tractor transmission oils, greases, stern tube greases, chainsaw oils, concrete release agents, wire rope lubricants, two-stroke oils, industrial and marine gear oils, stern tube oils and other total loss lubricants for use by private consumers and professional users.

Manufacturers, importers, service providers, traders and retailers, may submit applications for the Ecolabel. Traders and retailers may submit applications in respect of products placed on the trade market under their own brand names.

On order to apply for the European Ecolabel, lubricants have to meet requirements for performance, show limited toxicity to aquatic organisms, have high biodegradability and low potential for bioaccumulation and contain a high proportion of renewable

(bio-based) raw materials.

For more information, please visit the EU Ecolabel website: www.ecolabel.eu

Other nationally and internationally recognized ecolabels for lubricants include the following:

- Blue Angel, Germany (www.blauer-engel.de);
- Swedish Standard, Sweden (www.sp.se/km/grease);
- Nordic Ecolabel, Norway, Sweden, Finland, Iceland, and Denmark (www.nordic-ecolabel.org); and
- OSPAR Commission (www.ospar.org)

USED OILS AND THE ENVIRONMENT

2.1 Used lube oil definition and composition

According to the Basel Convention's technical guidelines on used oil re-refining or other re-uses of previously used oil, used oil means any used semi-solid or liquid product consisting totally or partially of mineral oil or synthesised hydrocarbons (synthetic oils), oily residues from tanks, oil-water mixtures and emulsions.

According to EU legislation, "waste oils" are all mineral or synthetic industrial oils or lubrication, which have stopped being suitable for the original intended use, such as used combustion engine oils, gearbox oils, turbines, hydraulic oils and lubricants (Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives Art. 3).

control of transboundary movements of hazardous wastes and their disposal.

Used oil is a dangerous polluting product, usually generated by its use as a lubricant in automotive vehicles and in industrial operations and classified as hazardous waste according to European environmental legislation.

Used oil mainly contains three types of dangerous pollutants:

- Polycyclic aromatic hydrocarbons (PAHs);
- Heavy metals; and
- Lubrication additives.

Used oil contains polycyclic aromatic hydrocarbons (PAHs), which result from fuel combustion during the running of engines or equipment and concentrated in lubricant oil. PAH concentration continually increases in crankcase oil with operating time. In addition, used oils contain important quantities of heavy metals, such as lead (Pb), zinc (Zn), nickel (Ni), cadmium (Cd), arsenic (As), copper (Cu) and chromium (Cr). Lubrication additives such as zinc dialkyl dithiophosphates, molybdenum disulphide, and other organo-metallic compounds are also present and are dangerous to the environment and human health.

These are the reasons why it is necessary to consider used oil as an important pollutant, consider the effects on the environment and take action. Pollution due to used oil has not received much attention compared to pollution from petroleum.

2.2 Associated environmental problems

As stated, used oils are classified as hazardous waste. Inadequate used oil management can have significant effects both on human health and the environment. These effects might be as follows:

Effects on fresh water marine and terrestrial ecosystems

Chronic pollution due to used oil from automotive traffic and industrial activity reaches millions of tonnes a year. Lubricant oil pollution can damage the soil, aquatic environments and the water supply. When used oil is leaked, spilled or improperly managed or recycled, it may reach water bodies through storm water runoff or direct discharge on water or land, causing adverse effects on the environmental health of ecosystems.

When oil is poured into the water, it forms a layer on the surface, which prevents oxygenation and it can suffocate and kill organisms that live in the water. Four litres of used oil can generate a slick of 4000 m2 on water. Also, petroleum hydrocarbons can be